D 35

United States
Environmental Protection
Agency

Industrial Environmental Research
Laboratory
Cincinnati OH 45268

Research and Development

EPA-600/PS7-80-154 Sept. 1980

EPA

Project Summary

Demonstration of Debris Basin Effectiveness in Sediment Control

NEWARK PUBLIC LIBRARY

JUN 24 1981

U. S. GOVT. PUBS.
DEPOSITORY 376

R. E. Bednar and D. J. Fluke

This study was conducted to determine the effectiveness of sedimentation ponds, as built during the mid-1970's, in the removal of suspended solids discharged in the runoff from lands disturbed by a typical surface mine in eastern Kentucky. The information in this report should be of interest to any program concerned with suspended solids control in runoff. The selected site included two watersheds in which very little erosion-causing activities had occurred, although strip mining was scheduled for one (Rhoades Branch).

Mining activities began with construction of a haul road and nine debris basins in August 1976 and were halted by the UMWA strike in December 1977. During this period, only four of the basins received runoff from disturbed areas. Monitoring showed that efficiency was much lower during storm events than during normal flows, due in part to construction and maintenance practices. The efficiency decreased with time because accumulated sediment was not removed from the ponds.

This study was conducted in cooperation with The Kentucky Department of Natural Resources and Environmental Protection, Office of Planning and Research, Frankfort, Kentucky.

The final report was submitted in fulfillment of Grant S-801276 by L. Robert Kimball and Associates, Consulting Engineers and Architects, Ebensburg, Pennsylvania, under the partial sponsorship of the Environmental Protection Agency. Work was completed as of December 1979.

best copy available

Introduction

Two similar and adjacent watersheds in eastern Kentucky were selected for study in an area where very little erosion-causing activity had occurred. Mining was proposed in only one valley (Rhoades Branch). The adjacent control watershed (Dick Branch) was selected to provide background data on water quality where man's activities continued to be limited.

The Rhoades Branch - Dick Branch Study Area (Figure 1) constitutes a small portion of the eastern Kentucky coal field in the upper reaches of Rockhouse Creek, a tributary to the North Fork of the Kentucky River. Although coal was mined in local areas within this watershed, no surface mining had been done in the study area prior to its selection for this demonstration.

Permission to establish the monitoring station in Rhoades Branch was obtained from Beth-Elkhorn Corporation, the surface and mineral owner. Beth-Elkhorn Corporation also pledged the cooperation of its contract miner, Tackett and Manning Corporation, who had earlier signed a cooperation agreement with KDNREP.

Tackett and Manning submitted a

EP 1.89/2:

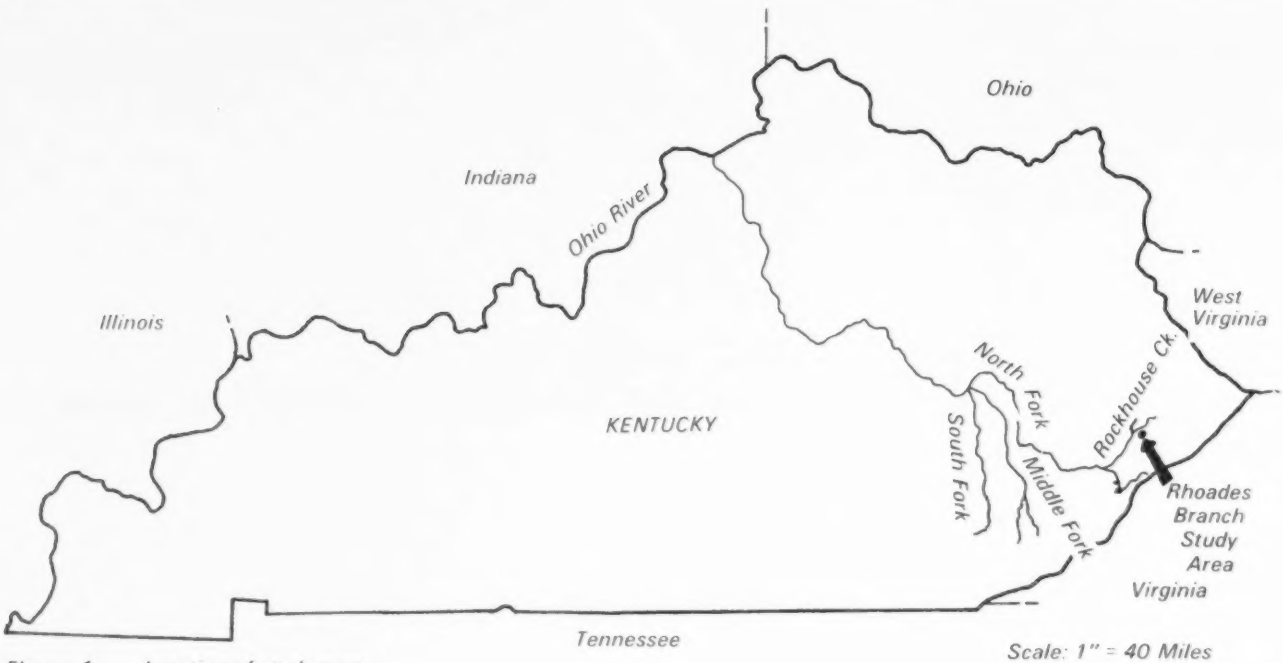

Figure 1. Location of study area.

mining plan for Rhoades Branch to KDNREP in June 1975, but indicated that a change in the coal market was necessary before they would begin mining. Construction of the monitor housing and weir was completed in March 1976, and electric power was installed in June. Equipment installation was complete by August 31, 1976. In August 1976, Tackett and Manning constructed an access and haul road in Rhoades Branch. They also constructed the debris basins as shown on their mining plan. These smaller earthen basins were designed in the field by the bulldozer operator, a common practice at that time in this area. Very little mining was done in Rhoades Branch until March 1977, although a head-of-hollow fill had been constructed earlier. Mining continued through the spring and summer of 1977. By the fall of 1977, the main sediment basin on Rhoades Branch upstream of the monitoring station had completely filled, and rather than clean the pond, the company built a dumped rock barrier across the stream 52 meters (170 feet) upstream of the monitor station.

Mining ceased with the advent of the UMWA strike, December 6, 1977, and was not resumed at the conclusion of the strike on March 27, 1978. The disturbed area was hydroseeded in August 1978, and monitoring continued through March 1979.

The project demonstrated the effectiveness of debris basins, as built in eastern Kentucky, in reducing the sediment load from strip mining disturbances to Rhoades Branch. It provided information on the change in water quality in Rhoades Branch during and after mining when compared to Dick Branch.

Conclusions

A system of sediment basins, as built in the Rhoades Branch demonstration area, was studied to determine their efficiency over the life of a surface mining operation. With time, efficiency of the basins decreased due to lack of maintenance (no clean-out of the ponds, reduced sediment storage, and shorter retention time). On the whole, the pond system delayed off-site sedimentation but did not prevent it.

The pond system consisted of in-stream ponds, where a bulldozer was used to excavate a portion of the stream channel, using the excavated material to form the downstream embankment. The principal spillway was usually a corregated metal pipe, with the open channel emergency spillway located at a slightly higher elevation on the opposite side of the embankment. Once the ponds were constructed, they were not maintained. Clogging of outflow pipes by floating debris and accumulated sediment caused excess use and rapid deterioration of the emergency spillway and embankment and short circuiting of the ponds.

The unplanned stoppage of mining in Rhoades Branch indicates that future mining within the basin will be done. New ponds, designed according to existing regulations will be required before this mining begins. The permanent monitoring installation coupled with the high likelihood of future mining makes this area a prime candidate for future sediment basin research.

The exposure of fresh rock surfaces during mining resulted in rapid chemical weathering. Significantly increased concentrations of sulfates, hardness, and conductivity occurred in Rhoades Branch during mining. Although the entire mining area was hydroseeded in August 1978, little change in the rate of weathering was apparent by the end of the study period in March 1979. Sulfates, hardness, and conductivity values have increased by

factors of 4.5, 3.5 and 3, respectively over their premining values.

The poor overall performance of the sediment basins studied may be attributed in part to the following factors.

1. The ponds did not have the required storage capacity.
2. No maintenance was performed.
3. The ponds were not cleaned out when they were filled.
4. The outlet pipes became clogged resulting in excessive use and deterioration of the emergency spillway.
5. No provision was made for removing the pond embankment and contents when no longer operable.

Recommendations

It was apparent during field work that maintenance and cleaning of the ponds were necessary. The importance of maintenance should be addressed and emphasized to inspection officials. A schedule for cleaning and disposition of dredge material should be required when the sediment basin plans are submitted. Pond embankments should be removed and properly reclaimed when mining has ceased to prevent gradual deterioration and eventual failure.

The required storage area is difficult to construct because of terrain constraints in the study area, even with ponds in a series. To overcome this problem, several techniques and operating procedures should be encouraged, including "at-source" controls such as minimizing disturbed areas, providing vegetative buffers, and constructing sediment traps. Methods to slow the velocity of runoff before it reaches the sediment ponds will decrese the amount and size of suspended sediment.

Following the field work in this study, the permanent station was turned over to the Department of Civil Engineering, University of Kentucky, so monitoring could be continued, at least intermittently. The interruption in mining strongly indicated that future mining will occur, and with changes regarding sediment basin design, occurring due to previous studies and the Office of Surface Mining Regulations, new basins would be constructed, and should be monitored.

The monitoring equipment has been in operation since September 1976, with random stoppages from extended power outages and during low or zero flow conditions. A general overhaul and equipment reconditioning should be performed before mining begins again.

R. E. Bednar and D. J. Fluke are with L. Robert Kimball and Associates, Consulting Engineers and Architects, Ebensburg, PA 15931
***John F. Martin** is the EPA Project Officer (see below)*
The complete report, entitled "Demonstration of Debris Basin Effectiveness in Sediment Control," (Order No. PB 80 222730; Cost: $9.00, subject to change) will be available from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
Industrial Environmental Research Laboratory
U.S. Environmental Protection Agency
Cincinnati, OH 45268

United States
Environmental Protection
Agency

Center for Environmental Research
Information
Cincinnati OH 45268

Postage and
Fees Paid
Environmental
Protection
Agency
EPA 335

Official Business
Penalty for Private Use $300